A μXPS Study of the Chemical State of Segregants at Growing Oxide/Alloy Interfaces

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The adherence of an oxide layer that forms on alloy surfaces as a result of high temperature oxidation often depends on the composition and structure of the oxide/alloy interface. This work follows previous Auger studies on two Al_2O_3/alloy interfaces after removal of the external alumina layer in vacuum. An attempt was made to use micro X-ray photoelectron spectroscopy to examine the chemical state of impurity and solute that segregated to the interface during oxidation and cooling. Both alloys were iron-based: FeCrAl and FeAl. It was found that on the FeCrAl, S was saturated along with Cr and C co-segregation, forming a multi-layer structure with enriched chromium sulfide at the oxide side and chromium carbide at the alloy side. On the FeAl, segregated sulfur only partially covered the interface, but was also present as a sulfide. The different interfacial chemistry between these two systems not only demonstrated the complexity that can exist under the dynamic oxidation conditions, but also showed how poor adhesion cannot be solely explained by sulfur contamination.

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